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A REVISION OF THE ENDEMIC HAWAIIAN REDUVIID GENUS *SAICELLA* USINGER, WITH DESCRIPTIONS OF FOUR NEW SPECIES (HETEROPTERA: REDUVIIDAE: EMESINAE)

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Abstract.—The Hawaiian genus *Saicella* is revised, and four new species are described: ***S. perkinsi*** from Oahu, ***S. lilinoe*** from Maui, ***S. kipahulu*** from Maui, and ***S. mulli*** from Hawaii. A key to species is provided, accompanied by distribution maps, habitus figures, and illustrations of key characters.

Key Words: Reduviidae, Hawaiian Islands, *Saicella,* new species, biogeography

Assassin bugs, in the family Reduviidae, are uncommon and elusive components of the native Hawaiian insect biota. Only two endemic genera, *Saicella* Usinger and *Nesidiolestes* Kirkaldy, both in the subfamily Emesinae, are known from the islands, containing a total of five currently described species between them. Even with the description of the additional new taxa now present in museum collections, it seems unlikely that the total native Hawaiian reduviid fauna will exceed 15 species. This stands in contrast to the native Hawaiian Nabidae, which appear to fill many typical reduviid niches in the islands. The latter group contains 25 described species, with an equal or greater number awaiting description. This is a striking reversal of family dominance in comparison to continental settings, where species of Reduviidae far outnumber those of Nabidae, and is a peculiarity of community organization in the Hawaiian archipelago and other isolated Pacific island groups. It is probably indicative of a difference in overwater dispersal abilities between these two groups of Heteroptera (Leston 1957), and of their relative capabilities to exploit underutilized ecological niches.

Here I revise the classification of *Saicella,* providing descriptions of four new species. The two previous species in this genus, *S. smithi* Usinger (1958) and *S. usingeri* Wygodzinsky (1966), were described from Maui and Kauai respectively. Two of the new taxa described herein are also from Maui, with the other two coming from the islands of Oahu and Hawaii. These new species now extend the known range of the genus throughout the archipelago, and it seems quite likely that further collecting will produce examples of this genus from Molokai and possibly Lanai.

Collections of *Saicella* have been sporadic at best over the last 100 years. The first two examples were taken by R. C. L. Perkins on Maui in 1894 and 1896, during his collecting work for the *Fauna Hawaiiensis.* They seem to have escaped the notice of Kirkaldy, who authored the treatment of Heteroptera for this series, and were not formally described until 1958, when R. L. Usinger happened across one of the specimens in the British Museum, and subsequently located the second in Honolulu, at the Bishop Museum. Usinger was eventually able to collect a series of a second spe-

cies on Kauai in 1961, which was described by Wygodzinsky (1966) in his monograph of world Emesinae. A few additional specimens were collected in the mid-1980's by researchers from the Bishop Museum during biological surveys on Maui and Oahu, and a series of specimens was reared from eggs by hobbyist William Mull on Hawaii. Even so, the sum total of specimens collected between 1894 and 1994 amounted to less than 50 individuals, many of them immatures.

This situation has changed markedly in the last several years, due to a better understanding of the microhabitats preferred by *Saicella* species and improvements in collecting techniques. In particular, the use of small scale pyrethrin fogs targeted at mossy logs and tree trunks in areas of wet native forest has been especially effective. This technique produced 80 specimens from five different localities on Maui and Kauai in only nine months during 1998 and 1999, thereby more than doubling the adult captures from the previous hundred years, and revealing two new species in the process. Continued use of such local fogging may well prove *Saicella* to be typical, though cryptic, components of wet, high elevation native forest communities on all the major Hawaiian volcanoes.

The comparatively high diversity of *Saicella* on Maui is an interesting biogeographic anomaly, especially considering that all three Maui species have come from Haleakala, the mountain that forms the eastern portion of the island, while none are yet known from the West Maui Mountains. The Haleakala species divide the mountain into three discrete areas of endemism, one in the area near upper Waikamoi Gulch, another on the central portion of the northern face in the upper Hanawi Gulch area, and a third in Kipahulu Valley (Fig. 12). These areas of *Saicella* endemism are roughly congruent with portions of the mountain retaining a surface of Kula Volcanic lavas with a mean age of 0.41 ma, which are surrounded by younger flows of the Hana Volcanics that erupted in the late Pleistocene, 0.4 ma later (Clague and Dalrymple 1987, Langenheim and Clague 1987). It is tempting to hypothesize that the patterns of speciation currently observed in Maui *Saicella* are the result of allopatry due to vicariance, with the eruption of the Hana Volcanics having isolated sections of the older Kula Volcanic surface, which then functioned as islands of rain forest habitat, but tests of this model must await a cladistic analysis. The Maui pattern is all the more interesting in light of the fact that no similar pattern of intra-island endemism is observed on the much older island of Kauai, where a single species, *S. usingeri,* occurs on both the Alakai Plateau and in the Makaleha Mountains, despite the isolation of these massifs from each other by sheer cliffs, deep valleys, and other topographic barriers easily as significant as those separating the three allopatric species on Maui.

Methods

Synonymies given are nomenclatural only. All measurements are given in millimeters. Characters typical of the genus that are noted in the generic description are not repeated in the individual species descriptions. To avoid confusion, tergite numbering in the descriptions refers to visible tergites; the basal tergites of many Emesinae are reduced or hidden (see Wygodzinsky 1966), so that the location of actual tergite I is often difficult to ascertain.

Institutional abbreviation codes used in the Material Examined sections are explained in the Acknowledgments section. In addition, information not found on original specimen labels but helpful in their interpretation is given in brackets in the Material Examined sections. Spellings for place names follow those found on the topographic maps of the United States Geological Survey, and do not include diacritical marks. In the following discussions, the word "Hawaii" refers to the island of Hawaii itself. If the entire Hawaiian island

chain is under discussion then the phrase "Hawaiian Archipelago" is employed.

Genus *Saicella* Usinger 1958
(Figs. 1–13)

Type species.—*Saicella smithi* Usinger 1958: 440.

Description.—Small, micropterous reduviids, length 4.5–6.0 mm (Figs. 1–2).

Body surface shining, portions of head, thorax, and basal abdominal segment often bearing short, appressed, wool-like pile. Ground color varying from pale green to yellowish brown, marked with red, dark brown, or black, legs often conspicuously annulate with dark brown or black.

Head short, divided into anteocular and postocular portions by deep transverse sulcus, both portions strongly convex above, anteocular section with sides subparallel when viewed dorsally, postocular section semi-globular both dorsally and laterally; eyes small, set laterally, lying below dorsal surface of head; rostrum 3 segmented, bent at first intersegmental suture, cylindrical, length of segment I subequal to lengths of segments II and III combined, segment I bearing 2+2 spinelike setae to either side of midline, segment II with 1+1 similar setae (Fig. 3); antenniferous tubercles large, antennae inserted near anterior margin of head, lacking long hairs in both sexes; buccula with a pair of socketed spine-like setae, gena with 3–4 similar setae.

Pronotum covering anterior half of mesonotum, divided into anterior and posterior sections by deep, forward curving transverse sulcus; anterior section subglobular, with a deep longitudinal median sulcus separating two elevated lobes; posterior section transverse; anterior acetabulae opening forward and downward. Scutellum (exposed portion of mesoscutum) subequal in length to posterior section of pronotum, bearing a long, erect spine. Metanotum subequal in length to scutellum, also with a long, erect spine. Forewings consisting of short, slender pads, reaching at most to base of abdomen, membrane absent.

Abdomen broadly attached to thorax, not constricted at base, connexival margins outwardly convex, broadly arcuate, occasionally sculptured, dorsal tergites often bearing small tumescences posteromedially, ventrites broadly convex. Male with seventh visible tergite triangular, elongate, often with a longitudinal medial keel, completely covering genital segments when viewed dorsally; ventrite VIII fully visible, large; pygophore large, length equal to ¼ total abdomen, sclerotized dorsally, posterosuperior process narrowing suddenly on distal half, coming to a spine-like point; parameres small, club-like.

Foreleg stout, coxa with 2 long, stout, socketed spines basally, followed by 2–3 smaller spines distally; trochanter unarmed; femur with 5 long, stout, socketed spines on basal ⅔ of ventral surface (Fig. 3), intermixed with long erect pale setae and set within a row of smaller spinules, length of the longest spines subequal to width of femur, inner dorsal surface of femur bearing about 10 moderately long socketed spines; tibia slender, ventral surface with two longitudinal combs of erect, pale, spine-like setae, small brushes of gold setae also present at tip on inner face, and on central section of outer face; tarsus two segmented, basal segment slightly shorter than second, both segments with numerous short setae on ventral surfaces, lacking specialized setae; claws curved, inner claw medially incised, outer claw with two small subbasal projections. Middle and hind legs slender and elongate, hind femur surpassing apex of abdomen, all segments bearing numerous very short, semi-erect, distally angling setae; middle and hind tarsi 3 segmented, these segments subequal in length.

Discussion.—Usinger (1958) considered the subfamilial placement of *Saicella* to be equivocal, due to the uniformly micropterous condition, and suggested that the genus might fall in either the Saicinae or Emesinae. Wygodzinksy (1966) provided detailed arguments for a placement in the Emesinae,

tribe Ploiariolini, an interpretation followed herein.

KEY TO THE SPECIES OF *SAICELLA*

1. Wing pads long; reaching to base of abdomen, surpassing posterior tip of scutellar spine when viewed from above (Fig. 2); Maui . . . . . *smithi* Usinger
– Wing pads shorter, not reaching to base of abdomen, usually not surpassing posterior tip of scutellar spine (except in *S. perkinsi*, where this spine is vertical), definitely not exceeding base of metanotal spine (Fig. 1) 2
2. Antennal segment I distinctly annulate, with alternating dark and pale bands (Fig. 1) 3
– Antennal segment I usually unicolorous brown, bearing at most a few faint indications of darker annulations 5
3. First visible abdominal tergite with conical tumescence anteromedially; ground color pale green overlain with darker markings; Maui . . . . . *S. lilinoe*, n. sp.
– First visible abdominal tergite lacking a conical tumescence; ground color yellowish brown, overlain with darker brown or reddish markings; Kauai and Hawaii 4
4. Wing pads extending to tip of scutellar spine; anterior lobes of pronotum dull, bearing patches of pale appressed hairs; abdomen with red markings laterally; Kauai . . . . . *S. usingeri* Wygodzinsky
– Wing pads tiny, hard to see, not extending past base of scutellar spine; anterior lobes of pronotum glabrous, shining; abdomen without red markings laterally; Hawaii . . . . . *S. mulli*, n. sp.
5. Pronotum with numerous long, slender, erect, pilose hairs; hind tibia unicolorous medium brown, without well defined annulations; anterior margin of first visible abdominal tergite strongly angled upward anteromedially; Oahu . . . . . *S. perkinsi*, n. sp.
– Pronotum lacking long, erect, pilose hairs, bearing only patches of pale, appressed hairs; hind tibia with numerous black annulations; anterior margin of first visible abdominal tergite not strongly angled upward anteromedially; Maui. . . . . *S. kipahulu*, n. sp.

Saicella smithi Usinger
(Figs. 2–3, 9, 12)

Saicella smithi Usinger 1958: 440.

Type.—Holotype, ♀, from Haleakala, Maui, 5,000 ft., in The Natural History Museum, London.

Diagnosis.—Recognized by the relatively long wing pads that reach beyond the apex of the scutellar spine to the base of the abdomen (Fig. 2); absence of obvious annulations on antennal segments I and II; and absence of raised tubercles on the abdominal tergites (Figs. 2–3, 9).

Redescription.—*Micropterous female: General coloration* yellowish brown, with darker brown markings on thorax and base of abdomen; legs multiannulate with dark brown; lateral portions and posterior margin of abdominal tergites sparingly marked with bright red.

Length 4.70 mm, maximum width (across abdomen) 1.50 mm.

Head length/width = 0.68/0.54, covered by a thick layer of short, pale, curling, recumbent setae; width of vertex 2.9× dorsal width of an eye (0.32/0.11); length of anterior lobe of head 2.50× dorsal length of an eye (0.40/0.16); eyes small, consisting of approximately 20 ommatidia each; length of posterior lobe of head 1.68× dorsal length of an eye (0.27/0.16); ocelli absent; length of antennal segments I–IV = 1.98/2.07/0.52/missing; rostrum length 0.85, reaching to bases of fore coxae; coloration of head yellowish brown, without contrasting dark markings; antennal segment I dark yellowish, distal ⅓ medium brown, basal half with very faint suggestions of 1 or 2 brown annulations, antennal segments II and III uniformly light brown.

Pronotum length (midline)/width = 0.57/0.63, covered by an obscure layer of short, pale, recumbent setae; coloration uniform golden yellowish brown; anterior section with lateral lobes shining, lacking patches of appressed setae; posterior section bearing a small, conical tumescence centrally.

Scutellum triangular, coloration uniformly golden yellowish brown, lateral angles bearing an obscure layer of short, pale, recumbent setae, central section produced into an erect, slender, backward angling spine posteromedially; length/width = 0.27/0.18.

Hemelytra short, micropterous, reaching to base of abdomen, separated medially by an erect, slender, backward angling spine

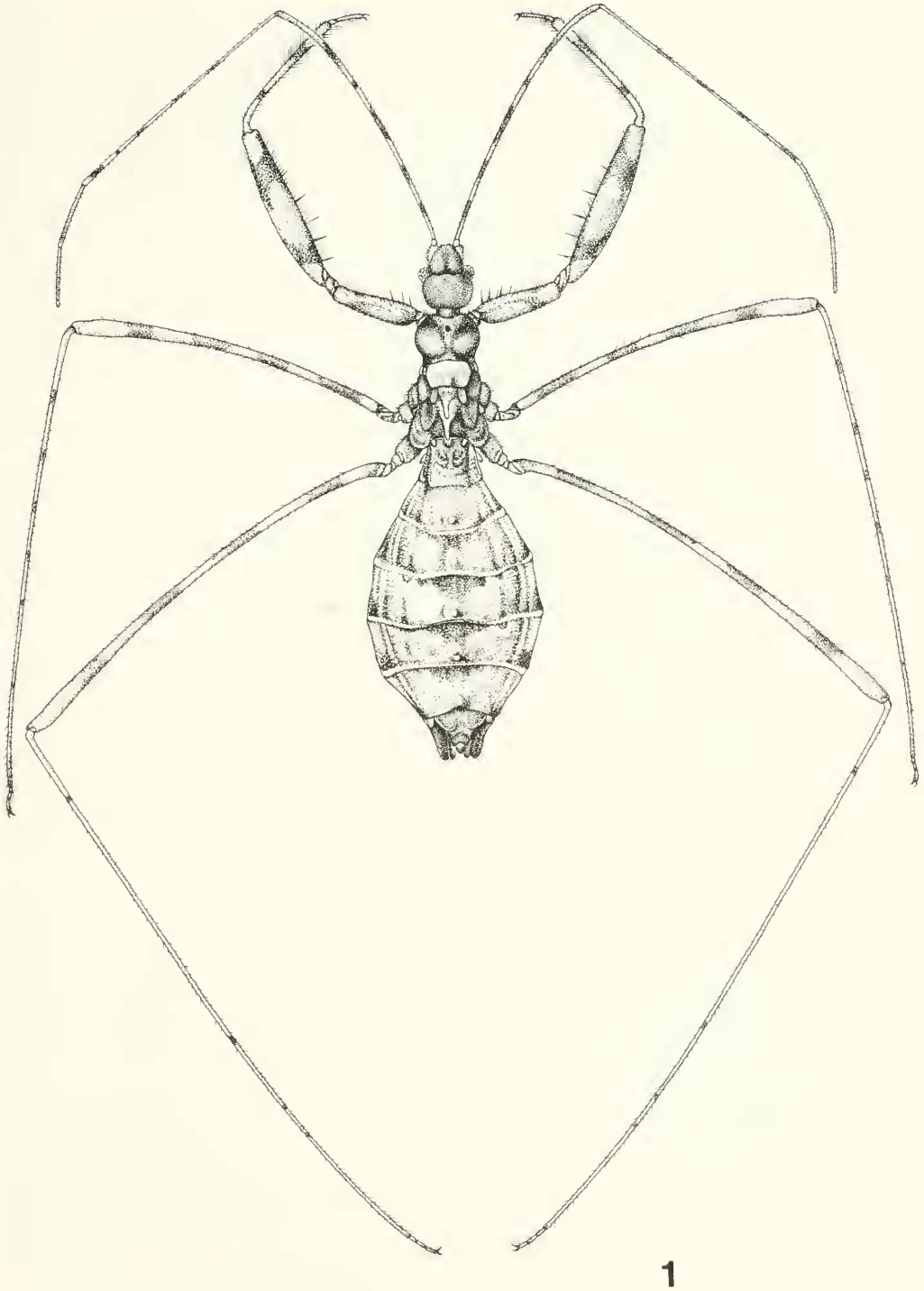
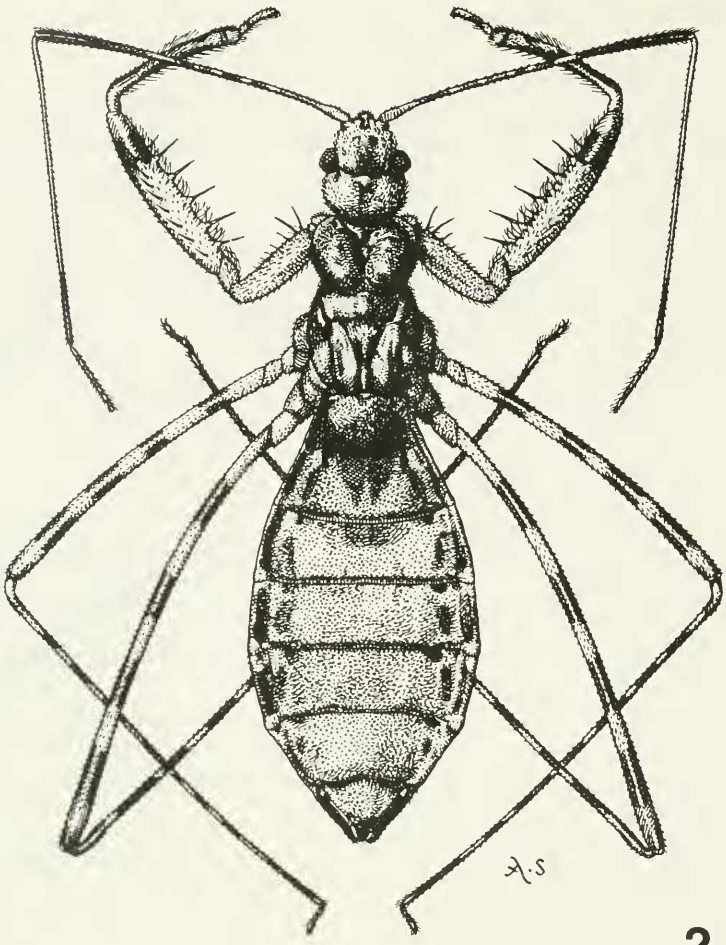
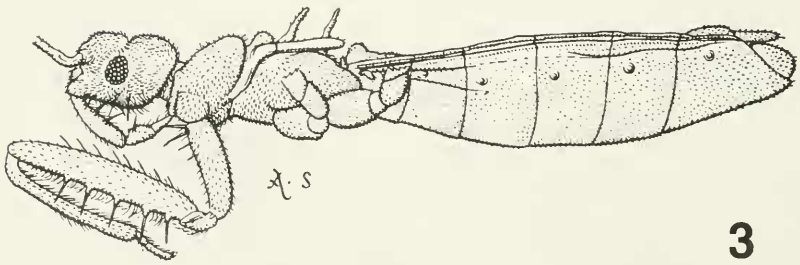


Fig. 1. *Saicella lilinoe*. Female, dorsal habitus (Young Sohn illustration).





Figs. 2–3. *Saicella smithi*, female (Arthur Smith illustrations). 2, Dorsal habitus. 3, Body and forelegs in lateral view.

arising from the underlying mesonotum, this spine similar in size, shape and orientation to that arising from scutellum; wing pads rugulose, with claval vein barely suggested, covered by an obscure layer of short, pale, recumbent setae, posterior margins rounded, membrane absent; coloration yellowish brown.

Legs elongate, with fore coxa approximately 3.5× as long as thick (0.63/0.18); fore trochanter bearing numerous slender erect gold setae; fore femur fusiform, over 5.7× longer than wide (1.26/0.22); coloration of legs yellowish brown with brown markings; fore femur yellowish brown basally, with a broad brown annulation on distal half; fore tibia with 3 brown annulations, knee pale, apex dark; middle and hind femora each with 4 brown annulations, these annulations roughly equal in length to intervening pale spaces; middle and hind tibiae with 5 and 7 brown annulations respectively, these annuli concentrated in the basal half of the segment; middle and hind tarsi uniform brown; lengths of leg segments as follows: fore femur/tibia/tarsal 1/tarsal 2 = 1.26/0.99/0.06/0.20; middle femur/tibia/tarsal 1/tarsal 2/tarsal 3 = 2.14/2.87/0.06/0.06/0.06; hind femur/tibia/tarsal 1/tarsal 2/tarsal 3 = 2.86/4.16/0.05/0.05/0.05.

Abdomen yellowish brown, with lateral and posterior sections of first visible tergite darker brown, lateral sections of first through sixth visible tergites also bearing irregular bright red maculations; connexival margins broadly arcuate, abdominal tergites lacking raised tumescences posteromedially, first through sixth visible segments dorsally concave, with lateral margins curved upward and narrowly emarginate, posterior margin of sixth visible tergite bisinuate, seventh visible tergite broadly triangular, flat, with a very small indentation at extreme posterior apex (Fig. 9); all tergites shining, covered by a sparse, obscure layer of very short, pale, recumbent setae.

Ventral surface yellowish brown, covered by an obscure layer of short, pale, recumbent setae; abdominal paratergites reddish.

Micropterous male: Unknown.

Distribution.—Maui (Haleakala, Waikamoi area) (Fig. 12).

Ecological associations.—Unknown.

Material examined.—HAWAIIAN ISLANDS, Maui: 1 ♀, Haleakala, 5,000 ft [130 m], III+IV 1894, R. C. L. Perkins (paratype, BPBM).

Discussion.—The description above was taken from a female paratype, housed in the Bishop Museum. It is one of the two original specimens of *S. smithi* on which Usinger (1958) based his description. The Arthur Smith figure accompanying Usinger's (1958) description, reproduced in Fig. 2, is accurate in most respects, but depicts obvious dark annulations on antennal segment I that are not present on the Bishop Museum specimen examined by the author.

Both of the above specimens were taken by Perkins from "Haleakala, 5,000 ft."; based on Perkins' field notes, the type locality must lie somewhere upslope of Olinda and west of Waikamoi Gulch. Much of the forest in this area has now been cleared for cattle ranching, but a tract is still protected in The Nature Conservancy of Hawaii's Waikamoi Preserve. Repeated surveys in this remaining forest block, however, have failed to produce further specimens of *S. smithi.* As a result, the male characters of this species remain unknown.

Saicella lilinoe Polhemus, new species

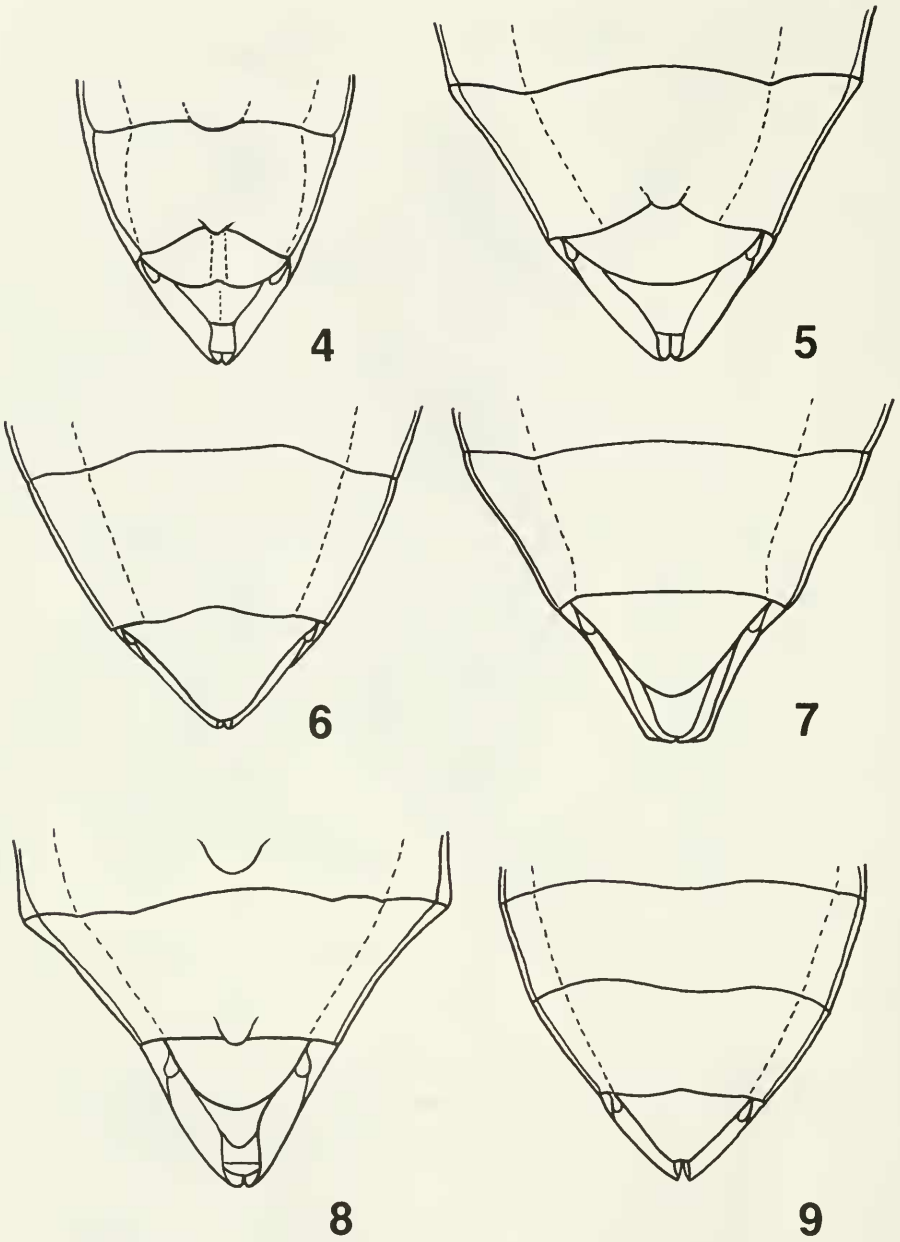
(Figs. 1, 8, 12)

Diagnosis.—Recognized by the short wing pads that do not reach beyond the apex of the scutellar spine (Fig. 1); strongly annulate antennal segments I and II (Fig. 1); and presence of raised tubercles posteromedially on the fourth through sixth visible abdominal segments (Figs. 1, 8).

Description.—*Micropterous male: General coloration* pale green, with darker brown markings on head, thorax and abdomen; legs multiannulate with dark brown or black (Fig. 1).

Length 5.25 mm, maximum width (across abdomen) 1.80 mm.

Head length/width = 0.80/0.56, covered by a thick layer of pale, appressed setae; width of vertex 4.8× dorsal width of an eye (0.44/0.09); length of anterior lobe of head 2.4× dorsal length of an eye (0.45/0.19); eyes small, consisting of approximately 20



Figs. 4–9. *Saicella* species, dorsal view of female terminal abdomen. 4, *S. mulli*. 5, *S. usingeri*. 6, *S. perkinsi*. 7, *S. kipahulu*. 8, *S. lilinoe*. 9, *S. smithi*.

ommatidia each; length of posterior lobe of head 1.63× dorsal length of an eye (0.31/0.19); ocelli absent; length of antennal segments I–IV = 3.10/2.75/0.75/0.55; rostrum length 1.00, reaching to bases of fore coxae; coloration of head uniform medium brown, without contrasting markings; antennal segment I dark yellow, bearing 5 evenly spaced dark brown annulations, tip light; antennal segment II dark yellow, bearing 6 evenly spaced dark annulations, tip dark; antennal segments III and IV uniform medium

brown except narrowly pale at extreme bases and tips.

Pronotum length (midline)/width = 0.75/0.50; anterior section yellowish green, becoming embrowned toward pleurae, lateral lobes shining, lacking setae, intervening longitudinal sulcus bearing numerous appressed pale setae; posterior section of pronotum milky greenish white, lacking setae, bearing a small, conical tumescence centrally.

Scutellum triangular, lateral angles black, central section pale green, produced into an erect, slender, backward angling spine posteromedially, this spine strongly curving when viewed laterally; a ring of pale, appressed setae present around base of spine; length (including spine)/width = 0.32/0.27.

Hemelytra short, micropterous, reaching only to middle of scutellar spine when viewed from above, separated medially by an erect, slender, pale green, backward angling spine arising from the underlying mesonotum, this spine similar in size, shape and orientation to that arising from scutellum; wing pads consisting of tiny, elongate flaps, venation and membrane absent; coloration black centrally, margins brown.

Legs elongate, with fore coxa approximately 4.0× as long as thick (0.80/0.20); fore trochanter bearing numerous slender erect pale setae; fore femur fusiform, 7.0× longer than wide (1.75/0.25); coloration of legs dark yellow with brown or black markings; fore femur yellowish brown basally, with a broad brown annulation on distal half; fore tibia with 3 diffuse brown annulations on outer face, knee pale, apex narrowly pale; middle and hind femora each with 4 brown annulations, these annulations broad and diffuse basally, becoming smaller than width of intervening pale areas distally; middle and hind tibiae each with 4–6 brown annulations, these annuli regularly spaced on middle tibia, more irregularly spaced on hind tibia, with a prominent black annulation on basal ¼, followed by other smaller annulations in distal half of segment; middle and hind tarsi uniform medium brown; lengths of leg segments as follows: fore femur/tibia/tarsal 1/tarsal 2 = 1.75/1.37/0.09/0.25; middle femur/tibia/tarsal 1/tarsal 2/tarsal 3 = 3.50/4.70/0.09/0.09/0.09; hind femur/tibia/tarsal 1/tarsal 2/tarsal 3 = 4.80/6.60/0.10/0.10/0.10.

Abdomen pale green, yellowish centrally, this ground color overlain with irregular black markings on entirity of first visible tergite and posterolaterally on second through sixth visible tergites, the lateral dark markings on third through sixth visible tergites extending inward along posterior tergite margins to form transverse bands, anterior sections of third through sixth visible tergites with blackish brown marks in the form of posteriorly directed triangles, this combination of markings giving the abdomen a transversely striped appearance (Fig. 1); connexival margins forming incipient knobs at sutures, intervening sections weakly concave; first visible tergite with a small, conical tumescence anteromedially, third through fifth visible tergites with smaller, more rounded raised tumescences posteromedially, sixth visible tergite triangular, longitudinally keeled on posterior half; all tergites shining, covered by a sparse, obscure layer of very short, pale, recumbent setae.

Ventral surface of head and thorax black, abdominal venter greenish brown, covered by an obscure layer of short, pale, recumbent setae; abdominal paratergites narrowly margined with pale green adjoining connexival margin.

Male genitalia with paramere stout, slightly curving, bearing a small lateral tab at tip; tip of pygophore narrowed and elongate, tapering evenly to truncate apex with a slightly expanded terminal cap.

Micropterous female: Length 5.70 mm, maximum width (across abdomen) 1.90 mm. Similar to male in general structure and coloration, but with abdomen broader and more strongly expanded; posteromedial tumescences on abdominal tergites more highly developed, particularly on fifth visible tergite, posterior margin of sixth visible

tergite broadly V-shaped, seventh visible tergite roughly triangular, rounded posteriorly (Fig. 8).

Distribution.—Maui (Haleakala) (Fig. 12).

Ecological associations.—All specimens so far captured have been taken by applying a light pyrethrin fog to mossy tree trunks and root masses of ohia trees (*Metrosideros polymorpha*). These insects appear to prefer the sheltered, almost cave-like situations found in cavities beneath multi-stemmed *Metrosideros* and fallen logs, and multiple specimens are often taken at a single spot, indicating a tendency toward aggregation.

Material examined.—*Holotype, micropterous* ♂*:* HAWAIIAN ISLANDS, Maui, Haleakala, Poo Uli Cabin area, near headwaters of Kuhiwa Stream, Hanawi Natural Area Reserve, 5,200 ft. [1,585 m.], 20°45.03′N, 156°07.40′W, 5–6 May 1998, CL 8324, D. A. Polhemus (BPBM). *Paratypes:* HAWAIIAN ISLANDS, Maui, Haleakala: 7 ♂, one ♀, same data as holotype (USNM, BPBM); 14 ♂, 9 ♀, same locality as preceeding, 5 May 1998, lot 01, pyrethrin fog on mossy ohia [*Metrosideros polymorpha*], J. K. Liebherr (CUIC); 11 ♂, 5 ♀, 5 immatures, State Fence Camp cabin, along headwaters of Heleleikeoha Stream, Hana Forest Reserve, 5,300 ft. [1,615 m.], 20°44.41′N, 156°06.12′W, 11–12 May 1998, CL 8326, D. A. Polhemus, J. K. Liebherr and C. Ewing (USNM, BPBM); 5 ♂, 4 ♀, same locality as preceeding, 12 May 1998, lot 01, pyrethrin fog on mossy ohia [*Metrosideros polymorpha*], J. K. Liebherr (CUIC); 1 ♂, Haleakala National Park, Kipahulu Valley, West Rim below Kuiki, 2,090 m. [6,855 ft.], 14 May 1993, lot 01, sifting moss from ohia [*Metrosideros polymorpha*], J. K. Liebherr and A. C. Medieros (CUIC).

Etymology.—The name "lilinoe" refers to the Hawaiian goddess of mists, an appropriate name for this species of the cloud forests.

Discussion.—In addition to the characters mentioned in the key and diagnosis, *Saicella lilinoe* may be easily recognized by its green and black coloration in living individuals, the striped appearance of the abdomen (Fig. 1), and the glabrous anterior pronotal callosities.

This species appears to be distributed across the northern face of Haleakala, from the Koolau Gap eastward to Kipahulu Valley. This is an extremely wet cloud forest zone, with precipitation exceeding 9,000 mm (360 inches) a year. A single specimen is also at hand from the upper section of Kipahulu Valley, further around the eastern tip of the island near to the type locality of *S. kipahulu*; this is the only place where two species of *Saicella* are known to be potentially sympatric.

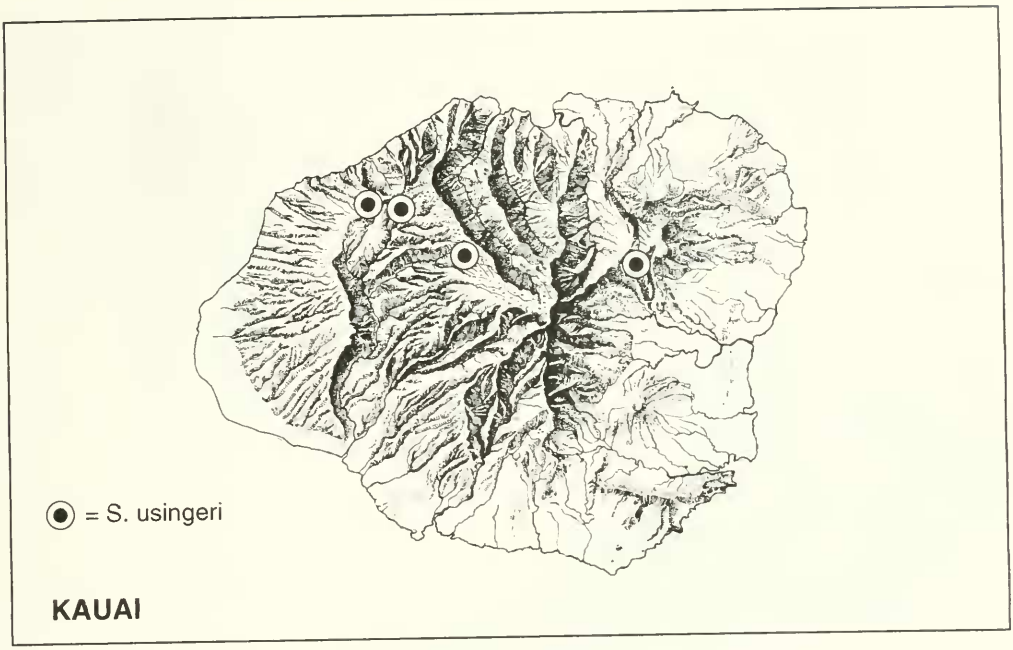
Saicella kipahulu Polhemus, new species
(Figs. 7, 12)

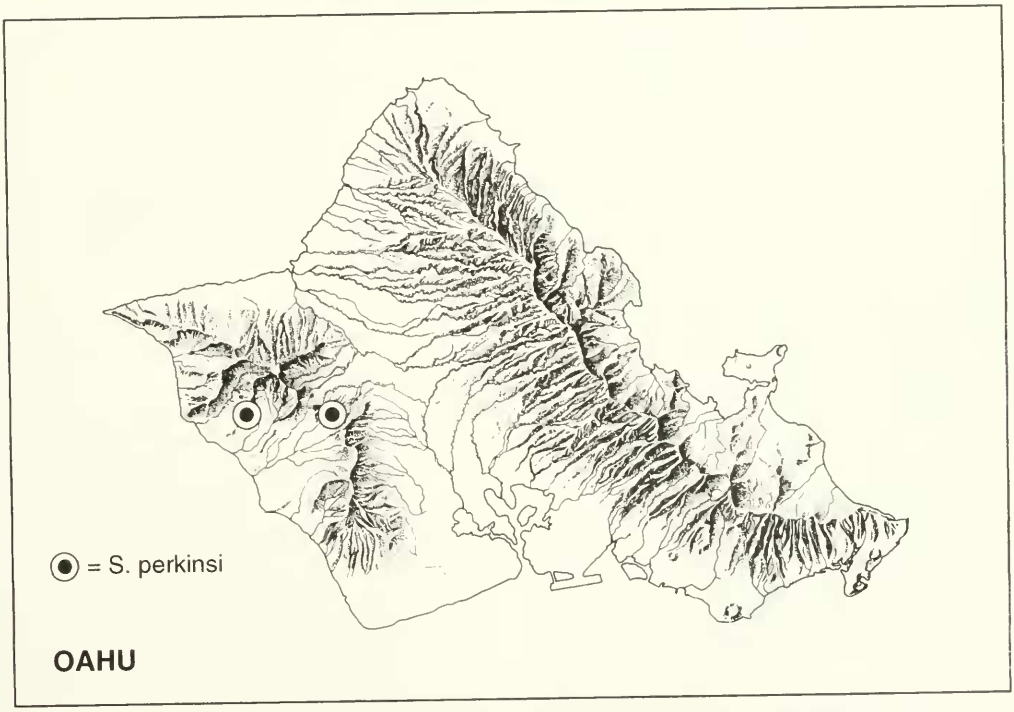
Diagnosis.—Recognized by the short wing pads that do not reach beyond the apex of the scutellar spine; unicolorous antennal segments I and II, and absence of raised tubercles posteromedially on the fourth through sixth visible abdominal segments.

Description.—*Micropterous male: General coloration* medium brown to yellowish brown, with dark brown or reddish markings on abdomen; legs multiannulate with dark brown.

Length 5.20 mm, maximum width (across abdomen) 1.25 mm.

Head length/width = 0.79/0.55, covered by a thick layer of pale, appressed setae; width of vertex 3.7× dorsal width of an eye (0.37/0.10); length of anterior lobe of head 4.2× dorsal length of an eye (0.50/0.12); eyes small, consisting of approximately 20 ommatidia each; length of posterior lobe of head 2.42× dorsal length of an eye (0.29/0.12); ocelli absent; length of antennal segments I–IV = 2.25/2.00/0.75/0.40; rostrum length 0.95; coloration of head uniform medium brown, without contrasting markings; antennal segment I medium brown, becoming slightly paler basally, lacking annulations; antennal segments II–IV uniform me-





Figs. 10–11. Distribution of *Saicella* species. 10, *S. usingeri* on Kauai. 11, *S. perkinsi* on Oahu.

dium to dark brown except narrowly pale at extreme bases and tips.

Pronotum length (midline)/width = 0.55/0.75; anterior section medium brown, lateral lobes bearing scattered, elongate patches of appressed gold setae, intervening longitudinal sulcus also bearing appressed gold setae; posterior section of pronotum yellowish brown, with a raised longitudinal median carina, set with scattered short, semierect setae.

Scutellum triangular, medium brown, central section pale yellowish brown, produced into an erect, slender, backward angling spine posteromedially, this spine strongly curving when viewed laterally; a ring of appressed gold setae present around base of spine; length (including spine)/width = 0.35/0.30.

Hemelytra short, micropterous, reaching nearly to tip of scutellar spine when viewed from above, separated medially by an erect, slender, yellowish brown spine arising from the underlying mesonotum, this spine similar in size and shape to that arising from scutellum, but more vertical; wing pads consisting of narrow, elongate flaps, bearing a few short, erect gold setae, venation and membrane absent; coloration medium brown.

Legs elongate, with fore coxa approximately 4.0× as long as thick (0.75/0.20); fore trochanter bearing numerous slender erect pale setae; fore femur fusiform, 6.0× longer than wide (1.50/0.25); coloration of legs dark yellow with brown or black markings; fore femur yellowish brown basally, with a broad brown annulation on distal half; fore tibia with 3 diffuse brown annulations, knee pale, apex dark; middle and hind femora each with 4 brown annulations, these annulations broad and diffuse basally, becoming smaller than width of intervening pale areas distally; middle and hind tibiae each with 6 brown annulations, these annuli regularly spaced on middle tibia, more irregularly spaced on hind tibia, with a prominent black annulation on basal ¼, followed by other smaller annulations in distal half of segment; middle and hind tarsi uniform medium brown; lengths of leg segments as follows: fore femur/tibia/tarsal 1/tarsal 2 = 1.50/1.20/0.10/0.25; middle femur/tibia/tarsal 1/tarsal 2/tarsal 3 = 2.60/3.70/0.08/0.08/0.08; hind femur/tibia/tarsal 1/tarsal 2/tarsal 3 = 3.60/5.10/0.08/0.08/0.08.

Abdomen dark yellow, this ground color overlain with irregular black markings on basal ⅔ of first visible tergite and anteromedially on second through sixth visible tergites, the dark markings on these latter tergites extending outward along anterior tergite margins to form transverse bands, giving the abdomen a transversely striped appearance, additional irregular dark markings present on connexival segments, sutures between tergites and connexiva irregularly blotched with red; connexival margins evenly convex and curving, lacking knobs at sutures; first visible tergite with anterior margin raised to form a low, triangular tumescence anteromedially, second through fifth visible tergites lacking tumescences, sixth visible tergite elongate, triangular, tip swollen and rounded, pale; all tergites shining, covered by a sparse, obscure layer of very short, pale, recumbent setae.

Ventral surface of head and thorax black, abdominal venter greenish brown, covered by an obscure layer of short, pale, recumbent setae; abdominal paratergites narrowly margined with pale green adjoining connexival margin.

Male genitalia with paramere stout, bearing a small lateral tab at tip; tip of pygophore narrowed and elongate, tapering evenly to acuminate apex.

Micropterous female: Length 5.75 mm, maximum width (across abdomen) 1.80 mm. Similar to male in general structure and coloration; abdomen broader and more strongly expanded, posterior margin of sixth visible tergite nearly straight, seventh visible tergite triangular (Fig. 7).

Distribution.—Maui (Haleakala) (Fig. 12).

Ecological associations.—The habitat

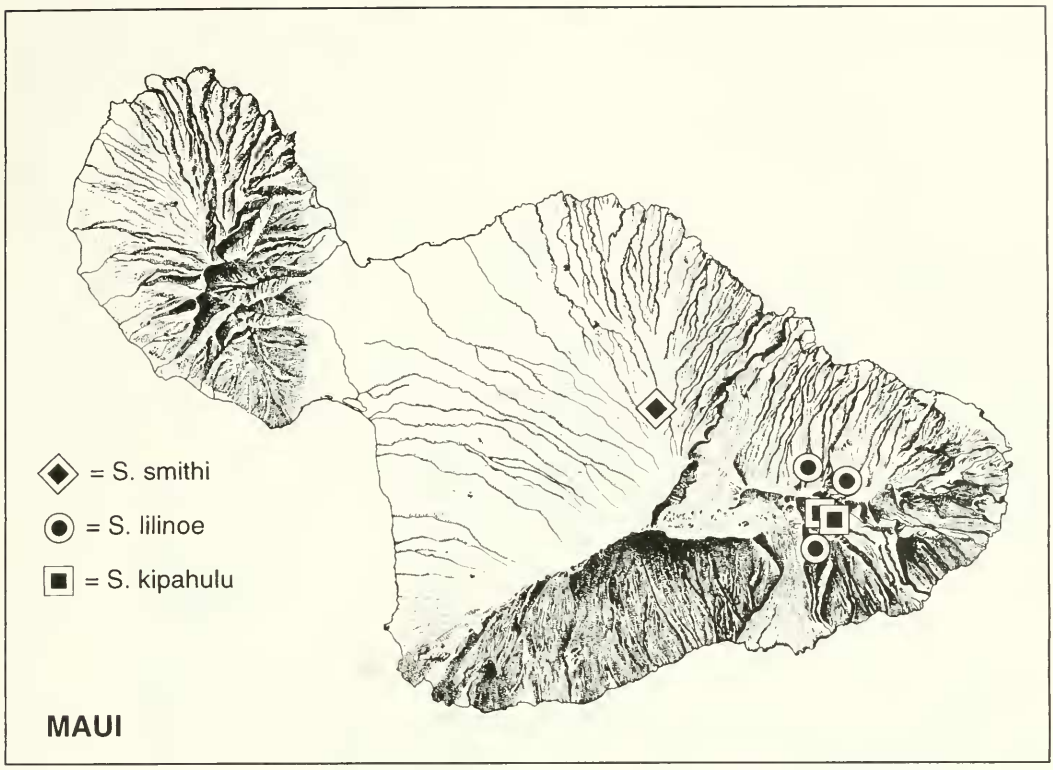


Fig. 12. Distribution of *Saicella* species on Maui.

preferences of this species are very similar to those of *S. lilinoe,* with individuals being taken from mossy tree trunks and root masses in wet montane forests.

Material examined.—*Holotype, micropterous* ♂*:* HAWAIIAN ISLANDS, Maui, Haleakala, West Camp, upper Kipahulu Valley, Haleakala National Park, 6,400 ft. [1,950 m.], 20°43.36′N, 156°07.79′W, 18–22 May 1998, CL 8331, D. A. Polhemus, B. H. Gagné and R. Takumi (BPBM). *Paratypes (all micropterous):* HAWAIIAN ISLANDS, Maui, Haleakala: 1 ♂, 8 ♀, same data as holotype (USNM, BPBM, CUIC); 1 ♂, 1 ♀, rim of pit crater downslope from West Camp, upper Kipahulu Valley, Haleakala National Park, 6,050 ft. [1,845 m.], 20°43.18′N, 156°07.73′W, 19 May 1998, 13:00–17:00 hrs., CL 8333, D. A. Polhemus, B. H. Gagné and R. Takumi (USNM); 1 ♂, 3 ♀, Kipahulu Valley, West Camp, Haleakala National Park, 1,850 m. [6,070 ft.], 28 February 1984, at night, F. G. Howarth (BPBM); 1 ♀, same data as preceding but 12 July 1983, on tree trunk, F. G. Howarth (BPBM); 3 ♀, same data as preceding but 17 July 1983, under wet ohia (*Metrosideros polymorpha*) bark, F. G. Howarth (BPBM).

Etymology.—The name "kipahulu" is a noun in apposition and refers to the Kipahulu Valley type locality.

Discussion.—In addition to the characters given in the key and diagnosis, *Saicella kipahulu* may be recognized by its brown and black coloration in living individuals, and by the scattered patches of appressed golden hairs on the anterior pronotal callosities.

On the basis of current collections, this species appears to be confined to Kipahulu Valley, a deep, cliff-bound gap cutting the eastern face of Haleakala. All collections have come from the upper section of the

valley, in the highest forest zone near the transition to the subalpine grasslands.

Saicella usingeri Wygodzinsky
(Figs. 5, 10)

Saicella usingeri Wygodzinsky 1966: 408.

Types.—Holotype, ♂ and allotype ♀ from Kawaikoi Ridge, Kokee, Kauai, in Bishop Museum, Honolulu.

Diagnosis.—Recognized by the annulate first antennal segment; relatively long wing pads that reach to the apex of the scutellar spine when viewed from above; yellowish brown coloration with red markings on the abdomen; and short length of the seventh visible female abdominal tergite, which is rounded posteriorly rather than broadly angulate.

Redescription.—*Micropterous male: General coloration* golden yellowish brown with slight greenish overtones, darker brown or red markings present on head, thorax and abdomen; legs multiannulate with dark brown.

Length 6.10 mm, maximum width (across abdomen) 1.45 mm.

Head length/width = 0.75/0.60, covered by a thick layer of wooly, appressed gold setae; width of vertex 3.1× dorsal width of an eye (0.37/0.12); length of anterior lobe of head 2.2× dorsal length of an eye (0.37/0.17); eyes small, consisting of approximately 20 ommatidia each; length of posterior lobe of head 2.06× dorsal length of an eye (0.35/0.17); ocelli absent; length of antennal segments I–IV = 4.10/3.50/0.80/0.60; rostrum length 1.00, reaching to bases of fore coxae; anterior lobe of head dark yellowish brown, posterior lobe of head dark brown; antennal segment I dark yellow, bearing 6 evenly spaced dark brown annulations of varying size, tip light; antennal segment II dark yellow, bearing 6 evenly spaced dark annulations, tip dark except at extreme apex; antennal segments III and IV uniform medium brown except narrowly pale at extreme bases and tips.

Pronotum length (midline)/width = 0.78/0.87; anterior section golden brown centrally, becoming embrowned toward pleurae, lateral lobes shining, bearing scattered patches of wooly, appressed gold setae, intervening longitudinal sulcus bearing numerous appressed gold setae; posterior section of pronotum yellowish brown, lacking evident setae, bearing a low longitudinal carina medially rising to a small, conical tumescence posteromedially.

Scutellum triangular, golden yellowish brown, central section paler yellowish, produced into an erect, slender, backward angling spine posteromedially, this spine angulate near middle when viewed laterally; a ring of pale, appressed gold setae present around base of spine; length (including spine)/width = 0.45/0.27.

Hemelytra short, micropterous, reaching to tip of scutellar spine when viewed from above, separated medially by an erect, slender, pale yellowish, backward angling spine arising from the underlying mesonotum, this spine similar in size, shape and orientation to that arising from scutellum; wing pads consisting of tiny, elongate pads, widening somewhat posteriorly, venation and membrane absent; coloration medium brown, margins slightly lighter.

Legs elongate, with fore coxa approximately 4.5× as long as thick (0.90/0.20); fore trochanter bearing numerous slender erect pale setae; fore femur fusiform, 7.5× longer than wide (1.87/0.25); coloration of legs dark yellow with brown or black markings; fore femur yellowish on basal ⅔, with a broad brown annulation on distal ⅓ of outer face; fore tibia with 3 diffuse brown annulations on outer face, knee pale, apex dark; middle and hind femora each with 4 brown annulations, basal annulation broad and diffuse, all annulations shorter than intervening pale areas; middle and hind tibiae each with 10–11 brown to black annulations on outer faces, these annuli of descreasing size distally but regularly spaced on middle tibia, more irregularly spaced and concentrated distally on hind tibia; middle and hind tarsi uniform medium

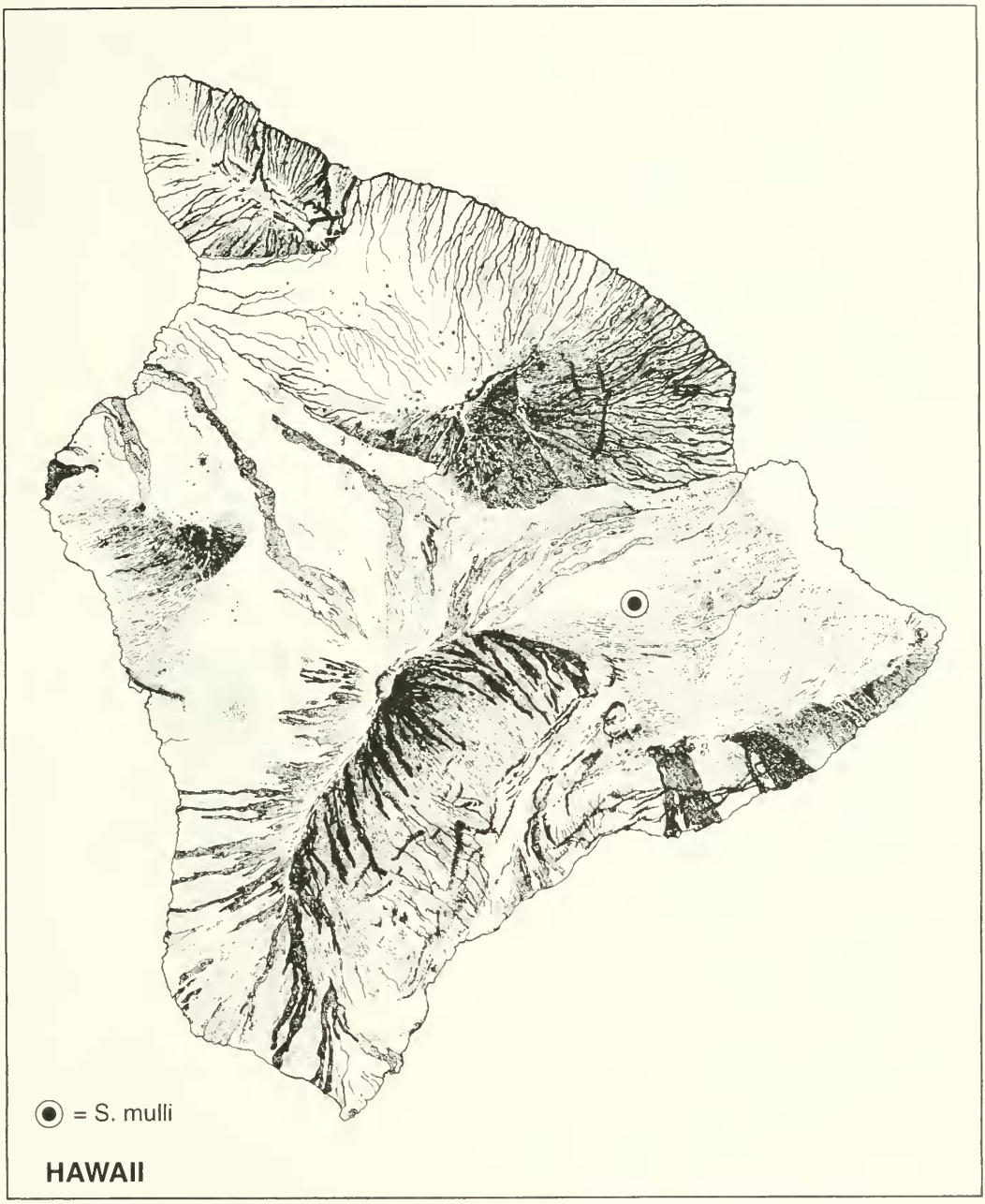


Fig. 13. Distribution of *Siacella mulli* on Hawaii.

brown; lengths of leg segments as follows: fore femur/tibia/tarsal 1/tarsal 2 = 1.87/1.35/0.12/0.20; middle femur/tibia/tarsal 1/tarsal 2/tarsal 3 = 3.75/5.40/0.07/0.07/0.07; hind femur/tibia/tarsal 1/tarsal 2/tarsal 3 = 5.00/8.20/0.10/0.10/0.10.

Abdomen golden yellowish brown with greenish overtones, this ground color overlain with irregular dark brown to black markings anteromedially on all tergites, markings on first, second, third, and sixth visible tergites more extensive, these mark-

ings extending outward along anterior tergite margins to form transverse bands, giving the abdomen a transversely striped appearance; paratergites irregularly blotched with red on central sections, with dark markings on posterolateral angles; connexival margins broadly arcuate, lacking knobs at sutures; first visible tergite broadly raised anteromedially but not bearing a tumescence, all other tergites flat, lacking raised tumescences, sixth visible tergite elongate and triangular, longitudinally keeled on posterior half; all tergites shining, covered by a sparse, obscure layer of very short, pale, recumbent setae.

Ventral surface yellowish brown mottled with dark brown, covered by an obscure layer of short, pale, recumbent setae; abdominal paratergites with spiracles creamy white.

Male genitalia with paramere club-like, bearing a small lateral tooth near tip; apex of pygophore strongly and suddenly narrowed, tip acuminate (see Wygodzinsky 1966: Figs. 124b, c).

Micropterous female: Length 5.50 mm, maximum width (across abdomen) 1.75 mm. Similar to male in general structure and coloration, but with abdomen broader and more strongly expanded; posterior margin of sixth visible tergite VI bearing a V-shaped indentation medially, seventh visible tergite short, broadly rounded (Fig. 5).

Distribution.—Kauai (Alakai Plateau) (Fig. 10).

Ecological associations.—A series of this species was taken near upper Koaie Stream by applying a light pyrethrin fog to mossy, fallen ohia (*Metrosideros polymorpha*) trunks, in the same manner used to obtain the Maui specimens discussed previously. Wygodzinsky (1966) states that Usinger obtained his type series by beating tree ferns (*Cibotium* sp.). Label data from another specimen collected by Swezey indicates it came from *Tetraplasandra,* an arborescent native forest plant with broad leaves.

Material examined.—HAWAIIAN ISLANDS, Kauai: 3 ♂, rainforest along Koaie Stream at USGS gauging station, near crossing of Mohihi–Waialae Trail, 1,130 m. [3,700 ft.], 22°06′47″N, 159°35′18″W, 7 January 1999, D. A. Polhemus (USNM); 1 ♂, 1 ♀, Alakai Swamp Trail, Kawaikoi Ridge, Kokee, 18 August 1961, tree ferns, R. L. Usinger (holotype and allotype, BPBM); 2 ♂, Kualapa, 2,000 ft. [610 m.], 23 October 1979, S. L. Montgomery (BPBM); 1 ♀, Kokee, 4–6 August 1961, Maa, Miyatake and Yoshimoto (BPBM); 1 ♂, 2 immatures, Kokee, 20 August 1925, on *Tetraplasandra,* O. H. Swezey (BPBM).

Discussion.—*Saicella usingeri* is endemic to Kauai; specimens are at hand from both the Alakai Plateau and the Makaleha Mountains, indicating that this species may occur on all the high mountain massifs of the island, including Namolokama and Mt. Kahili.

Saicella mulli Polhemus, new species
(Figs. 4, 13)

Diagnosis.—This species may be recognized by the near-absence of wing pads, and by the unusual condition of the seventh visible female abdominal tergite, which is divided into two lobes by a longitudinal median sulcus (Fig. 4).

Description.—*Micropterous male: General coloration* yellowish brown, with darker brown markings on head, thorax and base of abdomen; legs multiannulate with dark brown.

Length 5.50 mm, maximum width (across abdomen) 1.15 mm.

Head length/width = 0.70/0.55, covered by a thick layer of short, pale, recumbent setae; width of vertex 3.5× dorsal width of an eye (0.32/0.09); length of anterior lobe of head 2.36× dorsal length of an eye (0.37/0.11); eyes small, consisting of approximately 20 ommatidia each; length of posterior lobe of head 2.63× dorsal length of an eye (0.29/0.11); ocelli absent; length of antennal segments I–IV = 3.10/2.75/0.85/0.60; rostrum length 0.98, reaching to bases of fore coxae; coloration of head yel-

lowish brown, darker along longitudinal midline on frons and vertex; antennal segment I dark yellowish, distal ⅕ medium brown, basal ⅘ with 5 or 6 small brown annulations, antennal segments II and IV uniformly light brown.

Pronotum length (midline)/width = 0.72/0.69; anterior section medium brown centrally, lateral lobes shining, bearing scattered patches of wooly, appressed gold setae only anterobasally, intervening longitudinal sulcus bearing numerous appressed gold setae; posterior section of pronotum golden yellowish brown, lacking evident setae, broadly domed centrally but not produced to a sharp tumescence.

Scutellum triangular, medium brown, central section pale yellowish, produced into an erect, slender, backward angling spine posteromedially, this spine angulate near middle when viewed laterally; a ring of pale, appressed gold setae present around base of spine; length (including spine)/width = 0.26/0.27.

Hemelytra very short, micropterous, difficult to discern, not reaching to base of scutellar spine, separated medially by an erect, slender, backward angling spine arising from the underlying mesonotum, this spine similar in size, shape and orientation to that arising from scutellum but not as sharply angulate near middle when viewed laterally.

Legs elongate, with fore coxa approximately 3.85× as long as thick (0.77/0.20); fore trochanter bearing numerous slender erect gold setae; fore femur fusiform, over 7.4× longer than wide (1.62/0.22); coloration of legs golden yellowish brown with dark brown markings; fore femur yellowish brown basally, with a broad, diffuse brown annulation on distal ⅓; fore tibia with 3 diffuse brown annulations, knee pale, apex dark; middle and hind femora each with 4 brown annulations, most basal of these annulations diffuse, all annulations roughly equal in length to intervening pale spaces; middle and hind tibiae with 8 and 10 brown annulations respectively, these annuli concentrated in the basal ⅔ of these segments; middle and hind tarsi uniform brown; lengths of leg segments as follows: fore femur/tibia/tarsal 1/tarsal 2 = 1.62/1.29/0.07/0.25; middle femur/tibia/tarsal 1/tarsal 2/tarsal 3 = 3.10/4.50/0.10/0.10/10; hind femur/tibia/tarsal 1/tarsal 2/tarsal 3 = 4.50/6.60/0.08/0.08/0.10.

Abdomen with lateral margins broadly arcuate, all tergites lacking raised tumescences posteromedially, first through sixth visible segments dorsally concave, paratergites curved upward and narrowly emarginate, posterior margin of fifth visible tergite broadly V-shaped, sixth visible tergite elongate, triangular, domed along longitudinal midline on posterior half; all tergites shining, covered by a sparse, obscure layer of very short, pale, recumbent setae; coloration yellowish brown, irregularly mottled with darker brown.

Ventral surface medium brown, covered by a sparse layer of short, recumbent gold setae; abdominal paratergites light brown, spiracles whitish.

Male genitalia with paramere relatively slender, broadly curving; tip of pygophore narrowed and elongate, apex rounded.

Micropterous female: Length 5.30 mm, maximum width (across abdomen) 1.20 mm. Similar to male in general structure and coloration, but with abdomen broader and more strongly expanded; posterior margin of sixth visible tergite broadly V-shaped, rising to a knob-like tumescence posteromedially; seventh visible tergite short, bisected into two lobes along longitidinal midline by a deep sulcus, posterior margin broadly rounded (Fig. 4).

Distribution.—Hawaii (Volcano area) (Fig. 13).

Ecological associations.—Taken on mossy trunks of ohia trees (*Metrosideros polymorpha*).

Material examined.—*Holotype, micropterous ♂:* HAWAIIAN ISLANDS, Hawaii, reared from eggs laid by female taken at Puu Makaala, 3,700 ft. [1,130 m.], 10 August 1975, on mossy bark of ohia [*Metros-*

ideros polymorpha], W. P. Mull (BPBM). *Paratypes:* HAWAIIAN ISLANDS, Hawaii: 1 ♀, same data as holotype (BPBM).

Etymology.—Named in honor of William Mull, who collected the only known specimens and reared numerous individuals through all life stages.

Discussion.—*Saicella mulli* is endemic to Hawaii; the only known series was reared from eggs laid by a single female captured at Puu Makaala, near Volcano. It seems likely that this species will also be found to inhabit windward Mauna Kea and the Kohala Mountains.

Saicella perkinsi Polhemus, new species
(Figs. 6, 11)

Diagnosis.—Recognized by the long, pale, pilose hairs on the pronotum, and the absence of annulations on the middle and hind tibiae, and the enlarged, triangular form of the seventh visible male abdominal tergite (Fig. 6).

Description.—*Micropterous female: General coloration* golden yellowish brown, with darker brown markings on head, thorax and abdomen, red markings laterally on abdominal tergites; legs multiannulate with dark brown.

Length 6.10 mm, maximum width (across abdomen) 1.50 mm.

Head length/width = 0.81/0.55, covered by a thick layer of appressed, wooly golden setae, interspersed with numerous long, pale, erect pilose setae; width of vertex 4.0× dorsal width of an eye (0.40/0.10); length of anterior lobe of head 3.1× dorsal length of an eye (0.44/0.14); eyes small, consisting of approximately 20 ommatidia each; length of posterior lobe of head 2.6× dorsal length of an eye (0.37/0.14); ocelli absent; length of antennal segments I–IV = 4.10/3.75/0.95/0.70; rostrum length 0.97, reaching to bases of fore coxae; coloration of head uniform golden brown, without contrasting markings; antennal segment I uniform golden brown, without annulations; antennal segments II–IV medium brown, also lacking annulations.

Pronotum length (midline)/width = 0.81/0.90; anterior section golden brown, lateral lobes with thick linear patches of appressed, wooly, golden setae, intermixed with numerous long, pale, erect, pilose setae, intervening longitudinal sulcus also bearing numerous appressed gold setae; posterior section of pronotum golden brown, bearing numerous long, pale, erect, pilose setae, swollen centrally, not produced to a tumescence.

Scutellum triangular, lateral angles medium brown, central section golden brown, produced into an erect, slender, nearly vertical spine posteromedially, this spine straight when viewed laterally; numerous long, pale, erect pilose setae present around base of spine; length (including spine)/width = 0.15/0.25.

Hemelytra short, micropterous, reaching to base of erect, slender, golden brown, spine arising nearly vertically from the underlying mesonotum, this spine similar in size, shape and orientation to that arising from scutellum; wing pads consisting of tiny flaps, widening slightly on posterior halves, venation and membrane absent; coloration medium brown, set with a few long, pale, erect, pilose setae.

Legs elongate, with fore coxa approximately 4.0× as long as thick (1.0/0.25); fore femur fusiform, 7.4× longer than wide (2.00/0.27); coloration of legs golden brown with dark brown markings; fore femur yellowish brown on basal ⅔, with a broad brown annulation on distal ⅓; fore tibia with 3 diffuse brown annulations, knee pale, apex dark; middle and hind femora each with 4 brown annulations, these annulations roughly equal to length of intervening pale areas; middle and hind tibiae uniform medium brown, lacking annulations; middle and hind tarsi uniform medium brown; lengths of leg segments as follows: fore femur/tibia/tarsal 1/tarsal 2 = 2.00/1.00/0.12/0.22; middle femur/tibia/tarsal 1/tarsal 2/tarsal 3 = 3.90/5.25/0.06/0.06/0.07; hind femur/tibia/tarsal 1/tarsal 2/tarsal 3 = 5.70/8.90/0.06/0.06/0.07.

Abdomen yellowish brown, this ground color overlain with irregular dark brown markings centrally on all tergites and posterolaterally on paratergites; connexival margins broadly convex, evenly curving; first visible abdominal tergite strongly flexed upward anteromedially, remaining tergites flat, lacking tumescences, posterior margin of sixth visible tergite with small V-shaped indentation medially, seventh visible tergite triangular (Fig. 6); all tergites shining, covered by a sparse, obscure layer of very short, pale, recumbent setae.

Ventral surface of head, thorax and abdomen golden brown, covered by an obscure layer of short, pale, recumbent setae, intermixed on mesosternum with numerous long, pale, erect, pilose setae; abdominal paratergites irregularly marked with red bordering connexival margins.

Micropterous male: Unknown.

Distribution.—Oahu (Waianae Mountains) (Fig. 11).

Ecological associations.—Taken on mossy tree trunks at night.

Material examined.—Holotype, micropterous ♀, HAWAIIAN ISLANDS, Oahu, Waianae Mountains, Kaluaa Gulch, 1 mi. SE of Puu Hapapa, 700 m. [2,300 ft.], 10 October 1976, on mossy tree trunk, F. G. Howarth (BPBM). *Paratype:* HAWAIIAN ISLANDS, Oahu: 1 ♀, Waianae Kai Forest Reserve, Kamaileunu Ridge, 720 m. [2,360 ft.], 19 October 1975, north side of ridge on tree trunk at night, W. C. Gagne (BPBM).

Etymology.—Named in honor of R. C. L. Perkins, whose pioneering collections of native Hawaiian insects have given us an exceptional historical perspective regarding the islands' insect fauna.

Discussion.—*Saicella perkinsi* is endemic to Oahu, and the only specimens so far known have come from the leeward slopes of the Waianae Range. This is one of the drier portions of the island, and it seems curious that this or a related species has not been taken in the wet forests of the Koolau Mountains on eastern Oahu.

The long pilose hairs on the pronotum are present in one of the two specimens at hand, but mostly lacking in the other. It is presumed that in the latter case these hairs, being slender and delicate, were rubbed off during the specimen's collection or subsequent handling.

Acknowledgments

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